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Implementation of the Montreal Protocol

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Montreal, 26-28 July 1995

PROJECT PROPOSAL: JORDAN

This document includes the following project proposal:

- Umbrella Project for Conversion to CFC-free Technology at Five Star World Bank Co. Polyurethane Foam Factory

PROJECT COVER SHEET

COUNTRY: JORDAN

PROJECT TITLE: UMBRELLA PROJECT for Conversion to CFC-free Technology At Five Star Co. Polyurethane Foam Factory

SECTOR COVERED: Foamed Plastics

ODS USE IN SECTOR: 625t ODS (779t ODP equivalency)

PROJECT IMPACT: Eliminate the use of 20 tons/year CFC-11 (20 tpy ODP; 1994)

PROJECT DURATION: Nine Months

PROJECT ECONOMIC LIFE: Ten Years

TOTAL PROJECT COST: USD 66,000

PROPOSED MLF GRANT: USD 66,000

COST EFFECTIVENESS: USD 3.40 /kg/yr

COORDINATING NATIONAL BODY: Jordan Dept. of Environment, Div. of Air Pollution

IMPLEMENTING AGENCY: World Bank

PROJECT SUMMARY

Five Star Company is a small flexible slabstock foamer located in the Al-Hussian City Industrial Park near the Jordan University of Science and Technology, about 80 kilometers from Amman. They manufacture foams for the furniture and bedding industries, as well as produce their own line of mattresses. Five Star has selected methylene chloride as the replacement blowing agent. It will be more difficult to process, but with training and experience, yields can be as good as those with CFC-11. Methylene chloride is also classified as more toxic than CFC-11, so worker safety must be considered.

The factory is similar in operation and machinery to most slabstock operations. The project will address inadequate ventilation in the foam pouring area and a metering system for the methylene chloride. In addition to equipment needs, a second component of this project should be technical assistance in the foam manufacturing process.

TECHNICAL ASSESSMENT

This project will be reviewed by an OORG technical reviewer and his comments will be incorporated as Annex A.

PROJECT OF THE GOVERNMENT OF JORDAN
CONVERSION TO CFC-FREE TECHNOLOGY IN MANUFACTURING
OF FLEXIBLE POLYURETHANE FOAM

1. PROJECT OBJECTIVE

The objective of this project is to eliminate the use of CFCs in the manufacturing of flexible slabstock PUF at Five Star Company. The completion of this project will essentially remove CFCs from the Jordan flexible polyurethane slabstock industry.

2. SECTOR BACKGROUND

Jordan imports all of the CFCs used in the country. The CFC-11 is used in the manufacturing of flexible urethane foams and rigid insulation foams. The CFC-11 consumption in 1991 in the Jordanian foam sector, (including insulation foams for domestic and commercial appliances), has been established at 163 metric tons (Jordan Country Program, Table 2.1). On prior missions, five flexible slabstock foam factories were identified. One has moved to Sudan (International Foam) and one (Kolaghassi) has been included in a prior project. The three remaining foam factories consumed 114 tons of CFC-11. The change to methylene chloride will therefore make a significant reduction.

The Jordanian flexible slabstock industry is made up of five pouring factories. of which four are all ready approved MLF projects.

Kolghassi Foam	CFC-11.....20 tons
Arab Foam	CFC-11.....50 tons
Jordan Plastics	CFC-11.....24 tons
National Foam	CFC-11.....40 tons
TOTALS.....	134 tons

Five Star Company will add 20 tons more and bring the total to 154 tons usage in the flexible slabstock foams of the 163 tons listed for 1991 for all CFC-11 usage in Jordan. Since that is the blowing agent of choice for rigid insulation foams, I suspect national usage is understated (which would not be unusual).

3. ENTERPRISE BACKGROUND

Five Star is a 100% Jordanian, privately held company, owned by the Abu-Hussian family. The company was founded in 1987, presently employs 15 people with 12 of those in the foam department. The primary markets served are furniture and bedding. Five Star produces and markets its own line of mattresses. Annual sales for the company are approximately JD 1,300,000.

The foam is poured on a small Hyma machine with a traversing hose for laydown. Maximum size block is 1.6 meters wide by 1.2 meters high.

4. PROJECT DESCRIPTION

Five Star will need exhaust fans and hoods which will control and remove the more toxic methylene chloride fumes. Since access to the foam will be restricted by the hood, water lances will be needed to take care of any fire danger.

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The metering system for methylene chloride needs to be brought up to standard. A stainless steel day tank, piping, transfer pump, a pressure pump with motor, and a back pressure valve will be required. Five Star will also need a flow meter that is compatible with methylene chloride.

5. TECHNOLOGY

5.1 OVERVIEW

There are numerous technologies to replace the use of CFCs in flexible foams by non ODS or low ODS options. We refer to publications by UNEP and documentation available through UNDP for summaries of these technologies. Methylene chloride is one of the most cost effective technologies and is usually applied where process, industrial hygienic and regulatory conditions will permit it.

5.2 SELECTION

Five Star has joined all the Jordanian flexible slabstock companies in choosing to phaseout CFCs in the slabstock production through replacement by methylene chloride.

5.3 REQUIRED MODIFICATIONS

In all areas where methylene chloride and isocyanate are processed, adequate vapor containment and ventilation will have to be installed to assure safe workplace conditions. Where the hoods restrict access to the foam blocks, water lances will be provided for fire safety.

The pouring line will need a replacement metering system for the use of methylene chloride.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

The total project incremental cost of USD 66,000 is based on the incremental capital costs. The net incremental recurrent costs are expected to be offsetting.

6.2 CAPITAL COSTS

The following costs are expected to be incurred:

#	Upgrading of ventilation and encapsulation systems.....	USD	30,000
#	Water Lances, tank, and pump.....	USD	8,000
#	Methylene chloride metering equipment.....	USD	10,000
#	Production Trials, Chemical Losses.....	USD	5,000
#	Technology Transfer.....	USD	5,000
#	Contingency and rounding.....	USD	8,000

TOTAL INCREMENTAL CAPITAL COSTS.....USD 66,000

See Annex B for details

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6.3 OPERATING COSTS

Methylene chloride is lower priced than CFC-11, resulting in lower material costs. Offsetting that is more difficult processing, higher costs of catalysis and polyol, annual training and maintenance. These costs are difficult to calculate in advance as individual formulation changes and operating conditions tend to be site specific. However, expected annual savings on methylene chloride will approximately match the extra processing and chemical costs. Therefore, no recurrent incremental costs will be considered on this project. Annex C provides more detailed information.

6.4 COST EFFECTIVENESS

Cost Effectiveness = USD 66,000/20,000 kg/yr = USD 3.30/kg

6.5 UNIT ABATEMENT COSTS

C	=	ODS reduction project costs	USD	66,000
F	=	Capital Recovery Factor		0.16275
OC	=	Incremental Operating Costs	USD	0.00
OS/R	=	Operating Savings or Revenue		0.00
ODP	=	ODP Reduction in First Year, Kilograms		20,000

UNIT ABATEMENT COSTS USD/kg/yr 0.54

$$UAC = \frac{C(F) + (OC - OS/R)}{ODP}$$

7. FINANCING PLAN

The company requests an MLF grant, representing all eligible incremental costs in the amount of

USD 66,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

World Bank will be the implementing agency for this project and will work with the recipient of project under the guidance of the Division of Air Pollution of the government of Jordan.

8.2 PROCUREMENT

World Bank will review and supervise the procurement process, following World Bank guidelines and regulations.

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8.3 SCHEDULE

TASK	TIME TO COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation MLF Approval Procurement preparation Select vender/contractor	x xx	x				
2. Installation Arrival, Customs Machine installation			x x			
3. Start-Up Machine start-up Trials, training Certification			x xx	x		

9. REQUIRED REGULATORY ACTION

The project does not require regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 20 tons of CFC-11 in the first year of implementation. In fact, with International Foam moved out of the country, the remaining companies probably picked up that volume and the actual reduction of the combined Phase 1, Phase 2, and Five Star projects will be closer to 172 tons. The project employs commercially available and environmentally acceptable technology.

11. ANNEXES

Annex A: Technical review.

Annex B: Detailed information on Incremental Capital Costs.

Annex C: Detailed information on Incremental Recurrent Costs.

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ANNEX A
TECHNICAL REVIEW

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ANNEX B**ESTIMATED CAPITAL COSTS****FIVE STAR COMPANY**

EQUIPMENT DESCRIPTION	USD COST
Methylene Chloride System:	
150 gallon tank, stainless steel, unrated, with sight glass	3,600
3 Way Valve and Air Actuated Operator	550
Rotameter	550
1" and 1/2" ball valves	400
Pressure pump	850
Dryer	150
Silica Gel (Indicating)	15
Relief valve	15
Transfer Pump	850
Subtotal	7,330
Freight, insurance, installation	2,670
Total	10,000
Ventilation:	
Hood over Transition Conveyor	5,000
Hood over Cut-Off-Saw	10,000
Fan and duct for Cut-Off-Saw	10,000
Rework present duct to exhaust above roof	5,000
Total	30,000
Safety:	
3 full face respirators, chemical cartridge type	1,000
5 cubic meter galvanized tank	2,500
Pressure pump	1,000
Electrical	1,000
Water Lances and Piping	2,500
Subtotal	8,000
Production Trials (Chemical Losses)	5,000
Technology Transfer, (estimate 3 trips, 5 days, cover 5 plants)	5,000
Contingency and Rounding	8,000
TOTAL	66,000

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TO :
FROM : The Resource Pool**ANNEX C****RECURRENT INCREMENTAL COSTS**

It is normal to drop 5% to 10% in prime yield in factories where that change in ABA is instituted. The initial losses will be even higher, but proper formulation and operating techniques will fairly quickly regain all but the last 5 to 10%. Because foam pouring is somewhat of an art and solutions are site specific, the final percentage improvements will have to be made over the long term by the operators at each factory. With some process training and help with formulations, the companies should recover to the 5% level within a few months.

In the process, 20 tons/year of CFC-11 will be replaced by 17 tons/year of methylene chloride. In addition, the catalysts and polyol have to be changed, recurrent safety training, operating costs for the extra ventilation and increased maintenance will be needed. Assuming 200 tons of foam poured annually, these will impact the operating costs as follows:

ITEM	BEFORE	AFTER
20 T/Y CFC-11 @ 2500	USD 50,000	
17 T/Y Methylene Chloride @ 2000	-,-	USD 34,000
0.04 T/Y Extra Amine Catalyst @ 7500	-,-	USD 300
0.09 T/Y Extra Tin Catalyst @ 5600	-,-	USD 500
Annual electricity for forced ventilation	-,-	USD 300
Training, Maintenance		USD 1,700
TOTAL	USD 50,000	USD 36,800
DIFFERENCE		13,200

INCURRED COSTS FROM CONVERSION EFFORTS:**First year yield:**

Incremental Gain = USD 13,200
 Loss = 5% x 200 T/Y @ 1650 = - 16,500
 - 3,300 x 1.0000 = USD - 3,300

Second year yield:

Incremental Gain = USD 13,200
 Loss = 2.5% x 200 T/Y @ 1650 = - 8,250
 + 4,950 x 0.9090 = USD + 4,500

NET TWO YEAR TOTAL.....USD + 1,200

On the balance, a slight improvement of incremental recurrent costs exist. However, the gains are small and are based on estimates. Individual formulation modifications will result from the process trials and yields may differ from the predicted costs, but they certainly won't be better than the original CFC formulas. On that basis, recurrent incremental costs will not be considered.

JORDAN - FIVE STAR

TECHNOLOGY

The enterprise consumes about 20 te per year of CFC 11 to manufacture flexible slabstock polyurethane foam for furniture and bedding applications. It proposes to convert to a technology using methylene chloride. Methylene chloride is the most broadly applied CFC 11 replacement technology for this sector. Its use requires safety precautions (see below). There are currently no proven alternative technologies which are remotely as cost effective.

ENVIRONMENTAL ISSUES

Methylene chloride has a very low ODP and is not listed as a controlled substance.

The main issue is concerned with safe operation with this compound and specifically to control and limit worker exposure. The project provides for the upgrading of ventilation equipment to achieve this aim and water lances for cooling to prevent autoignition.

PROJECT COSTS

The project grant effectiveness is within EC guidelines. The items proposed are all necessary and justified. By the enterprise's estimate, the incremental operating costs and savings are about equal.

IMPLEMENTATION TIMEFRAME

Not included in the project documentation.

RECOMMENDATION

Approval provided that the implementation timeframe is satisfactory.



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